

REMARKS/ARGUMENTS

Applicant responds herein to the Office Action dated October 20, 2005.

Preliminarily, minor amendments have been made to the specification to improve its readability. The Examiner is respectfully requested to review, approve and enter the amendments to the specification herein.

Responsive to the objection to the title on grounds of non-descriptiveness, a new title has been entered which is believed to be descriptive of the invention. However, the applicant would be pleased to accept any other title that the Examiner might suggest.

Substantively, claims 1-3 and 7-10 stand rejected on grounds of obviousness over Okuda (US2002/0035762), in view of Aoki (5,635,053) or Chang (6,423,147).

Claims 4-6 and 11-14 stand rejected on grounds of obviousness over the previously mentioned Aoki or Chang documents, in further view of Hall (4,326,553) or Bran (6,039,059). Reconsideration is requested in view of the following remarks.

Several of the claims have been amended to improve their readability and to underscore their distinctions over the prior art. Support for the various claim amendments is present in the specification, including at page 14, lines 21-22; page 16, lines 15-16; and page 40, lines 2-4 for the amendments to claims 1 and 4.

Newly presented claims 21 and 23 are supported at page 54, lines 23-24; page 56, lines 12-13; and page 59, lines 4-6 of the instant specification. Newly presented claims 19, 20, 22 and 24 are supported at page 18, line 25 to page 19, line 2; and page 41, lines 11-20 of the instant specification.

In the invention according to claims 1-6, 19 and 20, an alkaline solution at an ordinary temperature (ambient temperature) and an ordinary temperature acid solution are utilized. Since the alkaline solution and the acid solution are not provided at high temperature, the quantity of solution for etching a substrate surface is reduced, preventing damage to the substrate surface. Further, the inventions according to claims 1-6, 19 and 20 call for either the injecting of droplets or the application of megasonic vibrations to the solution. These approaches assure that particles on the substrate surface are efficiently removed by physical action.

Thus, in the aforementioned claims, physical, impacting forces are applied to the substrate through the injection of the droplets or the application of the megasonic vibration which compensates for and substitutes for the reduction in particle removing effect due to the use of solution which is only at an ordinary (ambient) temperature.

The primary Okuda reference discloses a substrate processing apparatus that includes a gas-liquid mixing nozzle for generating a process liquid mist. Okuda does not, however, describe injecting droplets of an acid solution after injecting droplets of an alkaline solution, and no reference is made to using a liquid at an ordinary temperature.

Aoki discloses cleaning a semiconductor wafer by using an ammonium hydroxide-hydrogen peroxide mixture solution, hydrofluoric acid solution, and the like. However, this secondary reference clearly fails to bridge the gap in information in the primary reference, as it fails to mention or suggest the use of an alkaline solution and an acid solution at room temperature, nor the injection of droplets or the application of megasonic vibration.

In the other secondary reference, Chang describes a semiconductor wafer being immersed in an SC-1, and then being rinsed with a solution containing hydrofluoric acid and hydrochloric acid. However, Chang fails to discuss the use of an alkaline solution and an acid solution at ordinary temperature, and the injection of droplets or the application of megasonic vibration. While a cleaning solution between 0°C and 45°C is used in Chang, no mention is made of particularly selecting a liquid of ordinary temperature.

The reference to Hall discloses applying megasonic energy to a cleaning solution, but fails to discuss the use of an alkaline solution and an acid solution, and the use of the solution at an ordinary temperature.

Lastly, Bran describes a substrate cleaning system for cleaning a semiconductor wafer through the use of megasonic energy, but fails to discuss or disclose the use of an alkaline solution and acid solution and the use of a liquid solution at an ordinary temperature.

In addition, it bears mentioning that these references are each directed to a different type of a cleaning solution and cleaning methodology and none discloses the composite method of the present invention, which must consider all of its various steps as set forth in the instant claims.

Therefore, and as described above, the inventions according to claims 1-6, 19 and 20 are directed to the methods and a structural approach that clearly differs from the invention and

methodologies as described in each of the cited references. And, indeed, as noted, their combination clearly fails to direct one of ordinary skill in the art to the present invention. As such, the applicant respectfully submits that the invention according to claims 1-6, 19 and 20 cannot and should not be found to be rendered obvious by the prior art of record.

Turning to claims 7-14 and 21-24, it is noted that they define a first step of applying an alkaline solution to a surface of a substrate, a second step of supplying an acid solution to the surface of the substrate after carrying out a first step, and a third step of supplying the alkaline solution to the surface of the substrate after the second step. Significantly, in accordance with claim 7-14 and 21-24, the alkaline solution is being supplied after the acid solution has been supplied, thereby shortening the rinsing process time.

Turning to the prior art of record, none of the mentioned references, including Okuda, Aoki, Chang, Hall and/or Bran describe or suggest supplying an alkaline solution, an acid solution and an alkaline solution in the mentioned order, to the surface of a substrate.

Further, the inventions according to claims 7-14 and 21-24 attain not just the effect resulting from the supplying of alkaline solution and the effect resulting from the supplying of acid solution being repeated, but also the effect of shortening the rinsing process time by supplying the alkaline solution after supplying the acid solution. Therefore, applicant respectfully submits that the methods of claims 7-14 and 21-24 are not disclosed nor rendered obvious by the conventional procedures that use alkaline solution and acid solution.

Accordingly, the Examiner is respectfully requested to reconsider the application, allow the claims as amended and pass this case to issue.

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on January 20, 2006

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January 20, 2006

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